Lava Cap Mine Superfund Site

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY • REGION IX • FEBRUARY 2004

U.S. EPA Proposes Cleanup Plan for Mine Area Operable Unit

This Proposed Plan specifies how the U.S. Environmental Protection Agency (U.S. EPA), in cooperation with the State of California's Environmental Protection Agency (Cal EPA), proposes to protect people and the environment from contamination from the Mine Area of the Lava Cap Mine Site in Nevada County, California. It describes the cleanup alternatives that U.S. EPA is considering and U.S. EPA's preferred alternative, the one that U.S. EPA is proposing to implement. Finally, it asks for your thoughts on this proposal. U.S. EPA invites the public to comment at a public hearing on February 26 (see back page) or at any time during the period from February 25 to March 26, 2004. U.S. EPA will propose cleanup plans for the Lost Lake area and for groundwater at a later date.

At a Glance

The problem

Processing ore to extract gold from the Lava Cap mine produced finely ground tailings containing naturally occurring arsenic. These tailings were piled in the Little Clipper Creek watershed on the mine property. For many years a dam of logs across the creek held most of the tailings in place. During the summer of 1979, breaches in the dam's rotting logs released arsenic-contaminated mine tailings into Little Clipper Creek and downstream into Clipper Creek and Lost Lake. Then, during a major storm in January 1997, the log dam partially collapsed and floodwaters spread the tailings downstream. Although U.S. EPA stabilized the tailings pile in 1997 and 1998, more work is needed to manage the tailings so that people and the environment are not exposed to contamination from the Mine Area of the Site.

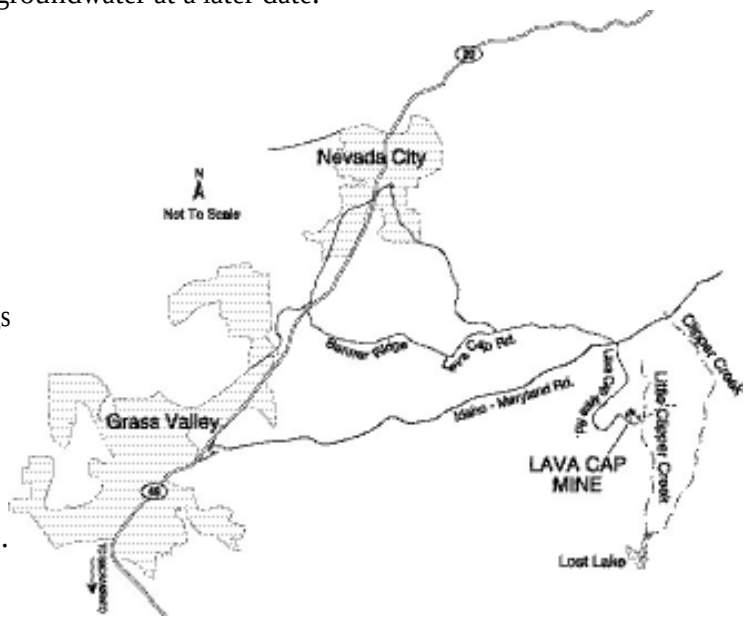


Figure 1: Vicinity of Lava Cap Mine Superfund Site

The proposed solution

U.S. EPA's preferred alternative for the contamination at the Mine Area includes:

- Mine tailings and waste rock, tailings dam, mine buildings, surface water: Consolidate, regrade, and cap tailings on-site with impermeable membrane; cover tailings and waste rock with soil and revegetate; replace the log dam with a rock buttress; divert clean surface water flow around the mine tailings; collect and treat contaminated water draining from the mine shaft and from the tailings; and remove tanks, vats, sumps, and contaminated soil from mine buildings, disposing of this material with the mine tailings or as hazardous waste where necessary
- Residences: Demolish residence closest to the tailings pile; remove soil around two other residences and replace it with clean soil; move excavated material to the mine tailings pile for long-term management
- Little Clipper Creek to Greenhorn Road: Excavate tailings and contaminated sediment accumulations and haul excavated material to the mine tailings pile for long-term management

Your concerns

You can provide comments on this plan either verbally during a public hearing or in writing, via letter, fax, or e-mail. (Please see the back page for the date, time, and location of the public hearing and the Contact Us box on page N for contact information.) U.S. EPA will consider your comments and respond in writing as we develop the final decision on the selected alternative.

Site Characteristics

Location

The Lava Cap Mine property covers about 30 acres in a forested area of the Sierra Nevada foothills east of Nevada City and Grass Valley, California. Large rural residential lots surround the mine property. The mine property is on the southern slope of Banner Ridge. The elevation at the central mine shaft is about 2,840 feet above sea level and drops off rapidly toward the southern property boundary.

The mine property is located entirely within the Little Clipper Creek drainage basin, which drains to the south away from the mine. The creek above the mine is seasonally dry. Water discharging from the mine produces year-round flows below the mine property. Little Clipper Creek flows downstream from the mine for approximately 1 mile until it joins with Clipper Creek and flows into Lost Lake.

Surface features

A large waste rock and tailings pile covers about eight acres of the mine property near the mine shaft. The waste rock is a gravel mixture of the various rock types underlying the Site. The tailings range from fine sand to silty clay, and appear dark gray when wet and unoxidized. Surface soil adjacent to Little Clipper Creek contains some natural sediment but is mainly made up of mine deposits. Beneath the surface, the area is characterized by layers of sedimentary rock. Gold-bearing quartz veins averaging five feet in width occur along inactive faults. The silver- and gold-rich ore also contains relatively high concentrations of sulfides rich in iron and arsenic. Processing the ore left behind tailings containing these elements.

Structures

The mine property contains several structures of varying ages and conditions. Historically, access to Lava Cap Mine during mining operations was through an adit, or entrance, connected by a horizontal tunnel to the central mine shaft. Buildings that formerly housed the mill, cyanide treatment facility, assay office, and storerooms, are in disrepair, but four residences have been maintained and inhabited. One residence is next to the waste rock pile; U.S. EPA considers this residence unsafe to live in, has relocated the occupant, and plans to demolish the residence as part of the cleanup. A second residence is located 300 feet from waste rock and tailings; U.S. EPA considers this residence unsafe to live in at present and is working to relocate the family living there. The other two residences are further away from the contamination sources.

Surface water

Although the adit has collapsed, the caved-in adit entrance discharges contaminated water continuously. Under normal, non-storm conditions, the flow rate from the adit is estimated to range from a low of around 50 gallons per minute (gpm) to a high of about 200 gpm. The flow in Little Clipper Creek just below the log dam consists of seasonal flow down Little Clipper Creek from above the mine and seeps from the tailings/waste rock pile. These seeps also show elevated levels of arsenic.

Normal flows in Little Clipper Creek and Clipper Creek are fairly low (typically no more than between 5 and 15 cubic feet per second for much of the year), but these can increase significantly during winter storm events. Estimated peak flows in the winter of 2000 were 4 cubic feet per second (cfs, or about 1,800 gpm) at the adit, 181 cfs below the log dam, and above 300 cfs in both Little Clipper Creek and Clipper Creek.

Groundwater

Fractures and joints in the bedrock underlying the Lava Cap Mine Site contain potable groundwater. This aquifer is the source of domestic drinking water in the vicinity of the site. The mine tailings and waste rock over the bedrock contain shallow saturated zones showing elevated levels of arsenic. Groundwater monitoring shows “background” or naturally occurring levels of arsenic in the underlying aquifer. However, levels of arsenic are higher in the domestic water supply wells on the mine property. This suggests that the mine may be contributing to elevated levels of arsenic within the aquifer. U.S. EPA is conducting a separate investigation of the groundwater and will present its proposed cleanup plan for the Groundwater Operable Unit at a later date.

Biota

The Ponderosa Pine plant community characterizes the Site. While Ponderosa pine dominates, Douglas fir, incense cedar, and scattered interior live oak are present along with various shrubs and groundcovers in the understory. Little Clipper Creek supports the Valley Foothill Riparian vegetation type, which has similar overstory trees but also includes Oregon ash and white alder and exhibits different understory species. Disturbed areas, such as the waste rock/tailings pile area and the areas around the abandoned mine buildings, contain a number of native and non-native (weedy) plant species associated with these habitat types.

Little Clipper Creek supports small rainbow trout as well as a few larger brown trout. The California red-legged frog, a federal threatened species and a California species of special concern, was reported in an on-site wetland in 1985 but was not found in a 1995 survey. However, on-site habitat is suitable for amphibians. Western skink and gopher snakes are common reptiles observed on-site, and several other reptiles species are likely present. The different habitat types support a variety of birds. Riparian areas support various duck species, great blue heron and great egret, and fish-eating raptors like ospreys and bald eagles. The forested areas are suitable for sharp-shinned hawks, Cooper's hawk, northern goshawk, long-eared owl, blue grouse, mountain quail, band-tailed pigeon, mourning dove, northern flicker, willow flycatcher, yellow warbler, California towhee, dark-eyed junco, and others. Merlin, California quail, loggerhead shrike, and song sparrow use open areas in the forests for foraging.

The mine area is in the range of many small and large mammals. Seven species of bats may live in the vicinity. Common small mammals include Virginia opossum, vagrant and ornate shrews, broad-footed mole, black-tailed jackrabbit, western gray squirrel, Douglas' squirrel, deer mouse, dusky-footed woodrat, California vole, and common muskrat. Wild pig and mule deer may forage in the area. Small and large mammal predators that may hunt the area include western spotted skunk, striped skunk, ringtail, American martin, fisher, ermine, long- ailed weasel, American mink, gray fox, coyote, bobcat, mountain lion, and black bear. The California Department of Fish and Game's Wildlife Habitat Relationships System indicates that several special-status wildlife species would occupy habitats in the area.

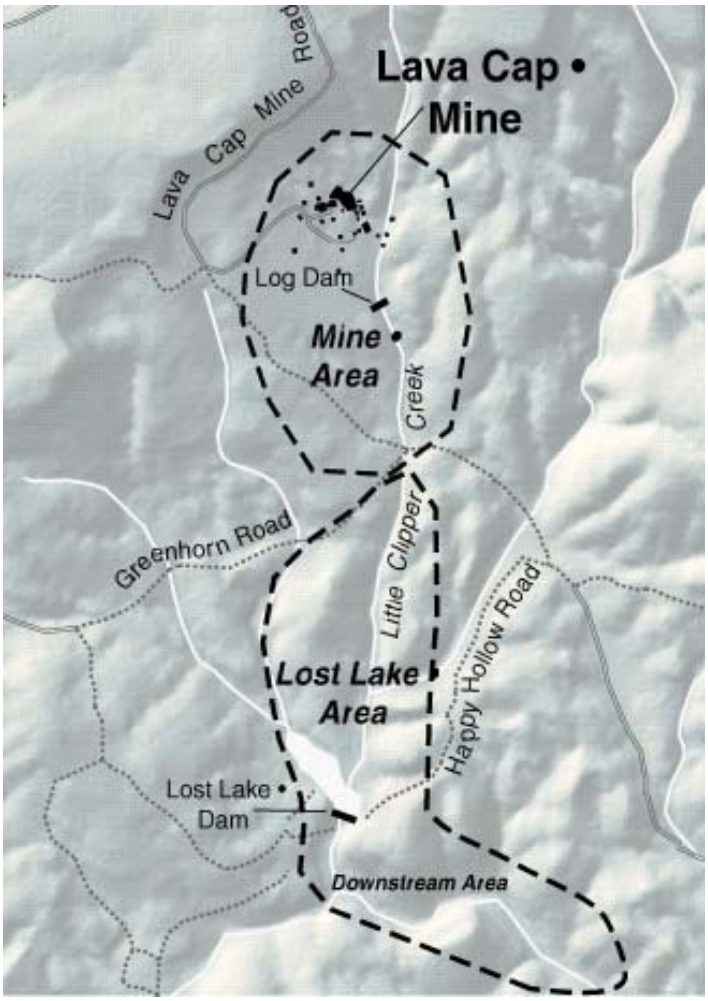


Figure 2: *Operable Units at Lava Cap Mine*

SITE HISTORY

The Lava Cap Mine Superfund Site is located in the historical gold-mining area in the northern foothills of the Sierra Nevada Mountains east of Nevada City, California. The Mine Area of the Site, once an active gold mine, now includes a large tailings pile, several abandoned mine buildings, and four residences.

Mining operations. Various entities operated Lava Cap Mine from 1861 to 1943, with several periods when the mine was not operating due to political and economic conditions. A flotation plant and, later, a cyanide process were used to extract metals from the ore. The ore contained naturally occurring arsenic, and the processing left the arsenic in the finely ground tailings. The tailings were deposited in the Little Clipper Creek drainage on the property.

Early investigations. In February 1978, the lessees of the mine property at that time submitted an application for a National Pollutant Discharge Elimination System (NPDES) permit to the California Regional Water Quality Control Board (RWQCB or Board), seeking to discharge 63 million gallons of mine water to Little Clipper Creek as part of a project to de-water the mine workings. RWQCB found high concentrations of arsenic in mine discharge water and did not issue a permit. In 1979, the decomposing log dam released tailings into Little Clipper Creek and the Board issued a Cleanup and Abatement Order to the owner and lessees of the mine property. Various public and private entities conducted sampling over the next decade and continued to find high concentrations of arsenic in surface water, mine discharge, waste rock, and tailings. U.S. EPA took sediment and soil samples on the Lava Cap Mine property in May 1994 as part of its preliminary investigation, finding elevated concentrations of arsenic and lead.

Release of contaminants. During a major winter storm in January 1997, the upper half of the log dam collapsed, releasing over 10,000 cubic yards of tailings into Little Clipper Creek. In May 1997, staff from the State of California's Department of Toxic Substances Control (DTSC) and Department of Fish and Game and from Nevada County's Department of Environmental Health inspected the mine and downstream areas. They found extensive deposits of tailings in Little Clipper Creek and downstream into Clipper Creek and Lost Lake. DTSC issued an information sheet in June 1997 warning of potential hazards from contact with Lost Lake sediments.

U.S. EPA response actions. In October 1997, the U.S. EPA Region IX Emergency Response Office determined the high arsenic concentrations and the mobility of the extremely fine-grain tailings warranted conducting a time-critical removal action under Superfund authority. During October and November 1997, U.S. EPA removed 4,000 cubic yards of tailings from just upstream of the damaged log dam and stockpiled it on the waste rock pile immediately to the north of the tailings pile. These tailings were placed on a liner and covered with another liner, clay cap, and waste rock. The project also included grading the tailings pile to reduce its slope, reinforcing the partially failed dam with large diameter rock, and placing and diverting Little Clipper Creek around the tailings pile. In 1998, U.S. EPA stabilized another smaller tailings release and further improved drainage.

U.S. EPA studies. In 1998, U.S. EPA evaluated the Lava Cap Mine Site to determine if it warranted listing on the National Priorities List (NPL) as a Superfund site. U.S. EPA formally listed the Lava Cap Mine Site on the NPL in February 1999. NPL listing allows U.S. EPA to spend Superfund money to investigate and clean up the Site.

U.S. EPA began the in-depth investigation of the nature and extent of contamination, called the Remedial Investigation or RI, in October 1999. As part of this effort, U.S. EPA studied the risks to both human and ecological health posed by the Site. These efforts identified arsenic as the primary chemical of concern for human health at the Site and arsenic and other metals as potentially harmful to plant and animal species. The RI report was released for public comment in November 2001. The Draft Feasibility Study (FS) for the Mine Area was completed in October 2003, and U.S. EPA has developed this proposed cleanup plan based on the results of that study.

Subdivision of the Site. To facilitate Site management, U.S. EPA has divided the Site into three project areas, or Operable Units (OUs). The three OUs include the Mine Area OU in the upper part of the Little Clipper Creek drainage, the Lost Lake OU in the lower part, and the Groundwater OU underlying the entire Site (see Fig. 2). This Proposed Plan is for the Mine Area Operable Unit of the Site.

Coordination and communication. Throughout U.S. EPA's response actions and investigations at the Site, U.S. EPA has kept State and County agencies, the business community, local non-profit organizations, and especially property owners near the Site informed of our activities and the results of our studies. U.S. EPA has funded a local organization, the Lava Cap Mine Superfund Coalition–South Yuba River Citizens League, to hire an independent technical advisor to help the community understand the issues and represent their concerns regarding the Site. U.S. EPA has also held annual public meetings and briefings of county staff and published periodic newsletters. These newsletters are available through U.S. EPA's web site at: www.epa.gov/region9/waste.

Contamination

Nature of contamination

U.S. EPA investigated the Lava Cap Mine Site for contamination from various metals, arsenic, and cyanide because they are used in the mining and processing of ore. The investigation showed that arsenic is the most prevalent contaminant at the Site and presents the only significant risk to human health and the primary risk to ecosystem health. As a result, arsenic is the primary contaminant considered in developing the alternatives for cleaning up the Site, although the same alternatives will also address the other contaminants found at the Site. Both EPA and the State of California consider arsenic a known human carcinogen. Potential non-cancer health effects from exposure to arsenic may include damage to tissues including nerves, stomach, intestines, and skin.

Extent of contamination

Sampling of several subareas of the Site indicated that tailings-impacted areas contained higher levels of arsenic than surrounding areas. For comparison, arsenic levels in nearby natural soils were about 20 milligrams per kilogram (mg/kg)[1] and about 25 mg/kg in nearby sediments unaffected by the mine tailings. By far the highest levels of arsenic at the Site were detected in sediments at the adit (up to 34,000 mg/kg) and in and around the cyanide and mill buildings (up to 31,200 mg/kg in soil and 14,300 mg/kg in ponded water). Arsenic levels in the waste rock and tailings pile are highest at the surface, averaging 1,340 mg/kg, and decreasing with depth to 223 mg/kg in the deepest sample. The estimated volume of tailings and waste rock is 210,000 cubic yards, of which about 50,000 cubic yards is tailings. Soils around the two residences closest to the tailings pile also showed levels of arsenic (1,750 mg/kg and 1,230 mg/kg) much higher than normal for the area, and soil at a third residence showed somewhat elevated levels. Surface water from the collapsed adit and from seeps in the tailings pile and at the log dam all showed elevated arsenic concentrations, the highest level detected being 910 micrograms per liter (ug/l)[2] detected at the adit during the low-flow period of late summer and early fall. Finally, one of four air samples collected in the tailings area contained arsenic exceeding the EPA preliminary screening level.

Principal threats

Arsenic was present in the ore mined at the Site, and remained in the tailings after processing. The tailings were placed, uncovered, in the adjacent Little Clipper Creek drainage. Arsenic also occurs in water at the Site: oxidation in the underground rock or in the tailings, combined with surface and groundwater intrusion, results in the release of dissolved arsenic. Surface water flows, such as, notably, the January 1997 flood but also more normal surface water flows, including those coming from the adit, can transport both the dissolved arsenic and arsenic-contaminated tailings downstream away from the source area. Arsenic present in the uncovered tailings can also become airborne as dust during the dry conditions of summer. Thus the mine tailings containing arsenic present the principle contaminant source and the principle threat from the Site. This source material is highly toxic and highly mobile and, as U.S. EPA's Human Health Risk Assessment for the Site shows, presents a significant risk should exposure occur.

Management of the Site through Operable Units

The different geographical areas and different contaminated media at the Lava Cap Mine Site present different issues. As a result, U.S. EPA has divided the Site into three different planning areas, or Operable Units (OUs; see figure 2). These are the Mine Area OU, the Lost Lake OU, and the Groundwater OU. The Mine Area OU involves fewer residents and, with its large disturbed area containing the contaminant sources, presents less complex cleanup alternatives. As a result, the overall cleanup strategy for the Lava Cap Mine Superfund Site is to first address the Mine Area OU while continuing to develop cleanup alternatives for the Lost Lake OU and simultaneously investigating potential groundwater contamination in the Groundwater OU. This Proposed Plan presents U.S. EPA's preferred alternative for the Mine Area OU.

The Mine Area OU contains the mine itself, which is the source of much of the contaminated surface water runoff, as well as the tailings pile, another source of contamination with the potential for catastrophic releases such as the 1997 event. U.S. EPA conducted a time-critical removal action immediately following the 1997 release to move tailings away

[1]One milligram per kilogram is equivalent to one part per million (ppm)

[2]One microgram per liter is equivalent to one part per billion (ppb)

from the failed dam, stockpile the tailings uphill in a safer location under a cover, and reroute surface water around the tailings. This effort stabilized the tailings pile and reduced surface water infiltration and airborne transport. However, the possibility of further catastrophic releases of tailings during future large storm events still exists, and contaminated runoff from the mine itself was not addressed during the removal action. By buttressing the tailings pile, capping the tailings, and controlling and treating surface water, the proposed Mine Area cleanup action will address these remaining problems and prevent further releases that would compromise the effectiveness of the eventual Lost Lake remediation downstream.

U.S. EPA's current judgment is that implementing one of the active cleanup alternatives proposed in this plan is necessary to protect the human and ecological health from releases of hazardous substances into the environment from the Lava Cap Mine Superfund Site.

Site Risks

The Lava Cap Mine site has been used, historically, for industrial purposes – gold and silver mining and ore processing – with some residential use. More recently, the surrounding areas have become primarily residential, with some recreational use. U.S. EPA assessed both human and ecological risks for the entire Lava Cap Mine Site based on continuation of current land uses. The risk assessments concluded that arsenic presents the primary risk to human and ecological health at the Site.

Human health risk

The Human Health Risk Assessment evaluated risks at the Mine Area to mine workers, residents on the mine property, and residents and recreational users of Little Clipper Creek below the mine. The primary means of exposure are through the incidental ingestion of arsenic in soil, sediment, surface water, and airborne dust. Residents of the mine property are also potentially exposed to elevated levels of arsenic in contaminated groundwater, which is used locally for water supply. U.S. EPA concluded that the excess lifetime cancer risk and the non-cancer risk to currently or potentially exposed people are greater than the acceptable risk ranges set in Superfund regulations and guidance. Excess cancer risks are estimated to be as high as 1 case per 200 exposed individuals for mine workers and residents of the mine property.

Ecological risk

The ecological risk assessment evaluated risks to soil microbial processes and a variety of terrestrial plants and animal life including invertebrates, fish, amphibians, birds, and mammals. It concluded that mine-related contaminants, primarily arsenic, pose a potential ecological risk both at the mine and downstream.

Remedial Action Objectives

The goals of a Superfund cleanup project are called remedial action objectives, or RAOs. The specific RAOs for the Mine Area OU include:

- protecting persons and the environment against exposure to unhealthful levels of arsenic in contaminated soil, sediment, and surface water;
- treating or containing arsenic source materials which are creating risks to human health and the environment;
- minimizing the migration of arsenic to groundwater and restoring surface water to its beneficial use as water supply; and
- ensuring long term protectiveness of the cleanup by constructing treatment and containment facilities to withstand seismic forces and flood events.

To achieve RAOs, U.S. EPA sets numeric cleanup goals for the contaminated media and design criteria for treatment and containment facilities. These and other aspects of the cleanup are governed by regulatory requirements that are either directly applicable to the Site, or at least relevant and appropriate. These are called ARARs (Applicable or Relevant and Appropriate Requirements). Potential ARARs for the Mine Area OU of the Lava Cap Mine Site include water-quality criteria specified in the State of California's Basin Plan and the California Toxics Rule. Other requirements that could potentially affect the choice of a cleanup plan include the Endangered Species Act, Fish and Wildlife Conservation Act, Clean Water Act, and National Historic Preservation Act, among others.

[3]One microgram per liter is equivalent to one part per billion (ppb)
[4]One milligram per kilogram is equivalent to one part per million

Table 1: Detailed Analysis of Alternatives/Part 1/On-Site Residences

		Alternative 1-3 Capping Around Residences	Alternative 1-4 Excavation Around Residences
	Description	Places clean soil cover and imposes land use restrictions.	Excavates existing soil and replaces it with clean soil. Eliminates need for land use restrictions.
Threshold Criteria	**Overall Protectiveness**	Protective. Makes surface soil safe for human contact. Soil beneath the surface would remain contaminated and would be subject to land use restrictions.	Protective. Removes contaminated soil from the yards of residences.
	Compliance with State and Federal Requirements	Complies with State of California land use covenant regulations governing implementation of institutional controls.	Complies with federal and state requirements for the characterization and disposal of excavated soil.
Balancing Criteria	**Long-term Effectiveness**	Effective with proper implementation of land use controls, which relies upon the vigilance of property owners and local agencies.	Most effective. Physical removal of contaminated soil is a permanent measure.
	Reduction of Toxicity, Mobility, or Volume	Reduces the mobility of contaminated soil underlying the new soil cover.	Permanently reduces toxicity, mobility, and volume of contamination by removing it from residential yards.
	Short-term Effectiveness	Effective because limited amounts of contaminated material would be handled. Residents may need to be temporarily relocated during capping.	Less effective because excavation of soil may result in contaminants becoming airborne. May require short term protective measures and temporary relocation of residents during excavation.
	Implementability	Implementable but requires a great degree of cooperation from the property owner and the oversight of state and/or local agencies.	Highly implementable.
	Cost (50-year present value)	**$250,000**	**$310,000**

For the Lava Cap Mine Site, the cleanup goals or preliminary remediation goals (PRGs) which have been determined by U.S. EPA to meet ARARs are 10 ug/l for surface water[3]; 20 milligrams per kilogram in sediment[4]; and 25 milligrams per kilogram in soil. PRGs are chosen to ensure that the cleanup reduces human health and ecological risks from the Site to acceptable levels. For the Lava Cap Mine, the PRG for surface water is set at the federal Maximum Contaminant Level (MCL) for arsenic of 10 micrograms per liter, or 10 parts per billion (ppb), which is protective of the potential beneficial use of water supply. The PRGs for sediment and soil were set at the respective background levels of arsenic found local to the Site in these media. Although the sediment and soil PRGs are higher than the cleanup levels that would have ideally been calculated solely based on risk, it is technically impossible to clean up a contaminant to levels lower than those present in the surrounding native soil and sediment.

Cleanup Alternatives

The Feasibility Study for the Mine Area OU examines three distinct subareas:

- the on-site residences (see Table 1),
- the mine buildings, tailings, and waste rock (see Table 2),
- and Little Clipper Creek immediately below the tailings pile (see Table 3).

For each of these subareas, in the Feasibility Study, U.S. EPA evaluated several cleanup alternatives as well as a "no action" alternative and an "institutional controls only"alternative under which no physical cleanup would take place, but access and land use restrictions would apply. For each of the subareas, U.S. EPA has dropped the "no action" and "insti-

Table 2: Detailed Analysis of Alternatives/Part2/Mine Buildings, Tailings, and Waste Rock

		Alternative 2-2 Contouring, Buttress, Water Treatment	**Alternative 2-3** Capping, Buttress, Water Treatment	**Alternative 2-5** Excavation, Onsite Disposal, Water Treatment	**Alternative 2-6** Excavation, Offsite Disposal, Water Treatment
	Description	Contours mine tailings to promote stability, replaces failed dam with a buttress, treats surface water flows.	Places low permeability cover over tailings, replaces failed dam with a buttress, treats mine drainage, tailings seeps.	Excavates mine tailings and places them in a lined disposal cell to be constructed onsite, treats mine drainage, leachate.	Excavates mine tailings and trucks them to an approved offsite disposal facility, treats mine drainage.
Threshold Criteria	**Overall Protectiveness**	Protective. Reduces risk by treating mine drainage and tailings seeps. Institutional controls necessary to limit access to tailings.	Protective. Reduces risk by treating mine drainage and tailings seeps, and isolating mine tailings. Land use restrictions necessary for capped area.	Protective. Reduces risk by treating mine drainage, eliminating tailings seeps, and isolating mine tailings. Land use restrictions necessary for disposal cell.	Protective. Reduces risk by removing tailings from the site and by treating mine drainage.
	Compliance with State and Federal Requirements	Complies with water quality standards and California land use covenant regulations (institutional controls).	Complies with water quality standards and State of California regulations pertaining to existing mine waste, and with California land use covenant regulations.	Complies with water quality standards and State of California regulations pertaining to existing mine waste, and with California land use covenant regulations.	Complies with water quality standards and state and federal requirements for characterization and disposal of excavated tailings.
Balancing Criteria	**Long-term Effectiveness**	Effective. Would provide long term treatment of mine discharge and tailings seeps. Land use restrictions depend upon vigilance of property owners and local agencies.	Very effective. Would provide long term treatment of mine discharge and tailings seeps and long term containment of mine tailings.	Very effective. Would provide long term treatment of mine discharge, eliminate existing tailings seeps, and contain mine tailings in a disposal cell with upper and lower liners.	Most effective. Would provide long term treatment of mine discharge, eliminate existing tailings seeps, and permanently remove mine tailings from the site.
	Reduction of Toxicity, Mobility, or Volume	Reduces toxicity and mobility of contaminants in water.	Reduces toxicity of contaminants in water and mobility of contaminants in water and tailings.	Reduces toxicity of contaminants in water and mobility of contaminants in water and tailings.	Reduces toxicity of contaminants in water and mobility of contaminants in water and tailings.
	Short-term Effectiveness	Effective. Contouring would involve less disturbance of contaminated mine tailings. Construction may require protective measures.	Effective. Capping would involve less disturbance of contaminated mine tailings. Construction may require protective measures.	Less effective. Extensive handling of contaminated mine tailings may cause tailings to become airborne and may increase short term risk. Construction would require protective measures.	Least effective. Extensive handling of contaminated mine tailings may cause tailings to become airborne and may increase short term risk. Construction, and trucking of tailings through neighborhoods, would require protective measures.
	Implementability	Implementable but institutional controls are a large part of this alternative and require cooperation of the property owner and the oversight of local agencies.	Implementable.	Less implementable because it requires significant handling of contaminated material.	May not be implementable. Identification of offsite disposal facility and acceptance of broader community necessary.
	Cost (50-year present value)	**$10,500,000**	**$12,300,000**	**$14,000,000**	**$16,600,000**

Table 3: Detailed Analysis of Alternatives/Part 3/Little Clipper Creek

		Alternative 3-3 Capping and Channelization	Alternative 3-4 Excavation
	Description	Places clean soil cover and alters stream channel to reduce erosion. Land use restrictions still necessary.	Excavates contaminated sediments and consolidates them for disposal. Eliminates need for land use restrictions.
Threshold Criteria	**Overall Protectiveness**	Protective. Provides a surface barrier to reduce human contact with contaminated sediment and lessens the potential for migration of tailings downstream.	Protective. Permanently removes contaminated sediment from the stream channel.
	Compliance with State and Federal Requirements	Complies with State of California regulations pertaining to beneficial uses of surface water, land use covenant regulations.	Complies with State of California regulations pertaining to beneficial uses of surface water.
Balancing Criteria	**Long-term Effectiveness**	Effective. Would reduce but not completely eliminate future risks to human health and the environment. Some erosion of the soil cover may be expected over time. Requires proper implementation of land use restrictions.	Most effective. Would eliminate the source of risk to human health and the environment through physical removal of the contaminated sediment.
	Reduction of Toxicity, Mobility, or Volume	Reduces the mobility of contaminated sediments.	Reduces toxicity, mobility, and volume by physically removing contaminants from the stream channel.
	Short-term Effectiveness	Effective because limited amounts of material would be handled. Construction activity may require protective measures.	Less effective because excavation of sediment may result in contaminants becoming airborne. Construction activity would require protective measures.
	Implementability	Implementable but relies in part on land use restrictions.	Highly implementable.
	Cost (50-year present value)	**$1,000,000**	**$500,000**

tutional controls only" alternatives from further consideration because they do not meet the basic minimum criteria for protectiveness required of Superfund cleanups. U.S. EPA has also dropped other Feasibility Study alternatives from the proposed plan evaluation where they were closely similar to retained alternatives (hence the breaks in the numbering of alternatives below).

On-site residences alternatives

Alternative 1-3 (Capping Around Residences). Clean soil would be placed around the residences. Some land use restrictions would apply.

Alternative 1-4 (Excavation Around Residences). Arsenic-contaminated soil would be excavated from around the residences and replaced with clean soil. No land use restrictions would be necessary.

Mine buildings, tailings, and waste rock alternatives

Alternative 2-2 (Contouring, Buttress, Water Treatment). The mine tailings would be re-contoured and vegetated in place but not capped. The failed log dam would be replaced by a rock buttress, and contaminated water would be collected from the adit and tailings for treatment.

Alternative 2-3 (Capping, Buttress, Water Treatment) (see Figure 3). The mine tailings would be capped in place with a low-permeability cover. The buttress and water treatment options would be implemented as in Alternative 2-2.

Alternative 2-5 (Excavation, Onsite Disposal, Water Treatment). The mine tailings would be excavated from the Little Clipper Creek stream channel and placed in a newly constructed landfill on the mine property. The disposal cell would have low-permeability liners both above and below the tailings. Water treatment option would be implemented as in Alternatives 2-2 and 2-3.

Alternative 2-6 (Excavation, Offsite Disposal, Water Treatment). The mine tailings would be excavated from the Little Clipper Creek stream channel and trucked offsite for disposal. The water treatment option would be implemented as in Alternatives 2-2, 2-3, and 2-5.

Little Clipper Creek alternatives

Alternative 3-3 (Capping and Channelization). Clean soil would be placed over the arsenic- contaminated sediments and the creek would be altered to reduce erosion. Some land use restrictions would apply.

Alternative 3-4 (Excavation). Arsenic-contaminated sediment would be excavated from the creek. No land use restrictions would be necessary.

Evaluation of Alternatives

Evaluation criteria. CERCLA specifies nine criteria to be used to evaluate cleanup alternatives (see Evaluation Criteria on page N). Two of these, protecting human health and the environment and meeting ARARs, are threshold requirements that any remedy must meet. Five others are balancing criteria used to differentiate alternatives that meet the threshold requirements. The final criteria are State and community acceptance criteria (these are called modifying criteria), which U.S. EPA will continue to evaluate during the remedy selection process. U.S. EPA will change its preferred alternative if necessary to accommodate the modifying criteria. Tables 1, 2, and 3 present U.S. EPA's evaluation of the alternatives for the three subdivisions of the Mine Area OU of the Lava Cap Mine Superfund Site.

Crossing the threshold

All of the active alternatives for all three subdivisions of the Mine Area OU would provide adequate protectiveness and meet all ARARs. Alternatives that rely on legal regulation of land use, called "institutional controls", would provide less protection for the on-site residences and would not meet all State requirements for surface water restoration.

Balancing effectiveness

Several balancing criteria consider long-term and short-term effectiveness, degree of hazard reduction, and ease of implementation of the various alternatives. For the mine buildings, tailings, and waste rock, the three engineered alternatives (2-3, 2-5, and 2-6) would reduce hazards associated with the contaminants equally well. Alternatives 2-3 and 2-5 are both implementable, although 2-5 (on-site disposal cell) would pose greater construction challenges and may increase short-term risk to on-site workers and residents during construction. Alternative 2-6 (off-site disposal) is the least implementable as it entails finding a disposal site and addressing the concerns of the community in which the disposal site is located, and it may also increase short term risk. Alternatives 2-3, 2-5, and 2-6 all reduce the mobility of contaminated mine tailings and the toxicity of surface water. For the mine residences and creekbed sediments, the active alternatives are all implementable, but the excavation alternatives, 1-4 and 3-4, provide greater long-term protectiveness and avoid the need for land-use controls.

Balancing cost

The costs for the active alternatives fall in a fairly narrow range. The alternatives for the mine buildings, tailings, and waste rock represent the bulk of the work at the Mine Area OU. Of these alternatives, excavation and off-site disposal is the most expensive at an estimated $16.6 million total present value over 50 years, while excavation and on-site disposal is estimated at $14 million and capping the tailings in place is estimated at $12.3 million. Alternatives for the mine residences and for the creekbed add marginally to the cost, so that the total 50-year present value of the most expensive combination of alternatives (for the Mine Area OU alone) is about $18 million.

Based on information currently available, U.S. EPA believes that, of the alternatives studied, the preferred alternative meets the threshold criteria and provides the best balance of tradeoffs with respect to the balancing and modifying criteria. U.S. EPA expects the preferred alternative to satisfy the following statutory requirements of CERCLA §121(b): (1) protect human health and the environment; (2) comply with ARARs; (3) be cost-effective; and, for surface water contamination (4) satisfy the preference for treatment as a principal element of the remedy. It is U.S. EPA's determination that permanently eliminating the contamination through resource recovery or innovative technologies is infeasible at this time. However, as part of the review process required by the Superfund law (CERCLA), U.S. EPA plans to formally re-evaluate the cleanup every five years, and will continue to consider new developments in cleanup technologies as part of this review process.

Preferred Alternative

Based on its evaluation of the cleanup alternatives developed for the Mine Area of the Lava Cap Mine Site, U.S. EPA prefers the following combination of alternatives.

Mine area residences

U.S. EPA prefers Alternative 1-4, which would involve excavating soil containing high levels of arsenic from around the existing residences and replacing it with clean soil. The relatively small amount of soil excavated under alternative 1-4 would be combined with the mine tailings for long-term management under alternative 2-3 below. The limited amount of excavation would not pose a serious risk to onsite workers or nearby residents, while overall protectiveness would be maximized. While this is the most costly alternative for the residences, it does not add significantly to the overall cost of the preferred alternative and would eliminate the need for land use restrictions at this part of the Site.

Mine buildings, tailings, and waste rock

U.S. EPA prefers Alternative 2-3. This alternative would involve:

- removing soil containing high levels of arsenic from the existing mine buildings (the buildings would remain standing as long as worker health and safety issues can be addressed),
- capping the mine tailings in place with an engineered cover and implementing land use restrictions,
- diverting uncontaminated surface water flows around the tailings,
- replacing the failed log dam with a rock buttress, and
- collecting and treating water containing high levels of arsenic (water which currently drains from the mine shaft and from beneath the tailings).

U.S. EPA estimates the total volume of tailings and waste rock at 167,000 cubic yards, or about 8,350 truck-loads. Alternative 2-3 would encapsulate the tailings in place, avoiding the significant potential for exposing cleanup workers and local residents to contaminants, which would likely occur during construction of any of the alternatives which involve excavating and moving the mine tailings. U.S. EPA prefers to implement Alternative 2-3 in phases. Under this approach, U.S. EPA would construct the cover and surface water controls first, then evaluate the effectiveness of surface water controls before designing and constructing a surface water treatment plant. This approach could avoid significant overbuilding of the plant, potentially reducing construction, maintenance, and ongoing energy costs. It would also allow U.S. EPA time to consider innovative treatment technologies, which could be pilot-tested at the Site.

The cost of this alternative is in the middle of the cost range for the active alternatives, but it is significantly easier to implement and safer for onsite workers and local residents during remedy construction, while providing a similar level of long-term effectiveness and overall protectiveness as the more expensive alternatives.

Little Clipper Creek area from below the log dam to Greenhorn Road

U.S. EPA prefers Alternative 3-4, which would involve excavating tailings (which were deposited in the stream channel as a result of the 1997 log dam failure) and trucking them back to the mine for handling under Alternative 2-3 above. As with the residences, the limited amount of excavation in the creekbed would pose a limited risk to onsite workers but little risk to nearby residents, and overall protectiveness would be maximized. While this is also the most costly alternative for the creekbed, it does not add significantly to the overall cost of the preferred alternative, and eliminates the need for land use restrictions for this part of the Site.

U.S. EPA believes that this combination of alternatives represent an implementable, cost-effective solution, and that they will best meet the objective of immobilizing the contaminants and preventing impacts to the environment downstream from the mine area.

We want your ideas!

U.S. EPA would like to know your thoughts on this Proposed Plan. We encourage you to review the Feasibility Study (FS) and other documents in the Administrative Record (see Information Repositories, at right) for a more comprehensive understanding of the Site. We welcome your comments on any of the alternatives presented in the FS and summarized in this Proposed Plan.

During the comment period for this Proposed Plan, you can submit comments in writing via mail, fax, or e-mail (see the Contacts box on the next page). You can also comment verbally at a public hearing on this proposal on February 26, 2004, in Nevada City, California. U.S. EPA responds in writing to all relevant verbal and written comments and may revise its proposed remedy as a result of comments received.

U.S. EPA will formally announce the selected remedy in a document called the Record of Decision (ROD). U.S. EPA expects to complete the ROD later in 2004. The ROD will include a summary of the public comments received and U.S. EPA's responses to those comments. The remedy specified in the ROD for the Mine Area Operable Unit of the Lava Cap Mine Superfund Site may differ from the preferred alternative in this plan as a result of the public comments or new information.

..... For More Information .....

Information Repositories

Pertinent documents related to the Lava Cap Mine Superfund site can be found at the locations listed below. Documents at these repositories are part of the Administrative Record for the site.

- **Superfund Records Center**
  (the most extensive collection of documents)
  95 Hawthorne Street, Suite 403S
  San Francisco, CA 94105
  Telephone: (415) 536-2000

- **Nevada County Library**
  980 Helling Way
  Nevada City, CA 95959
  Telephone: (530) 265-7050

- **Grass Valley Public Library**
  206 Mill Street
  Grass Valley, CA 95945
  Telephone: (530) 273-4117

U.S. EPA Contacts

Dave Seter
Project Manager
Telephone: (415) 972-3250
Fax: (415) 947-3528
Email: seter.david@epa.gov

Don Hodge
Community Involvement Coordinator
Telephone: (415) 972-3240
Fax: (415) 947-3528
Email: hodge.don@epa.gov

U.S. Environmental Protection Agency, Region 9
75 Hawthorne Street (SFD-3)
San Francisco, CA 94105-1309

You may leave a toll-free message at **(800) 231-3075** and your call will be returned.

LAVA CAP MINE
PUBLIC HEARING

February 26, 2004 • 6:30 - 9:30 p.m.
Nevada County Board of Realtors
336 Crown Point Circle
Grass Valley

PUBLIC
COMMENT PERIOD

February 25 through
March 26, 2004

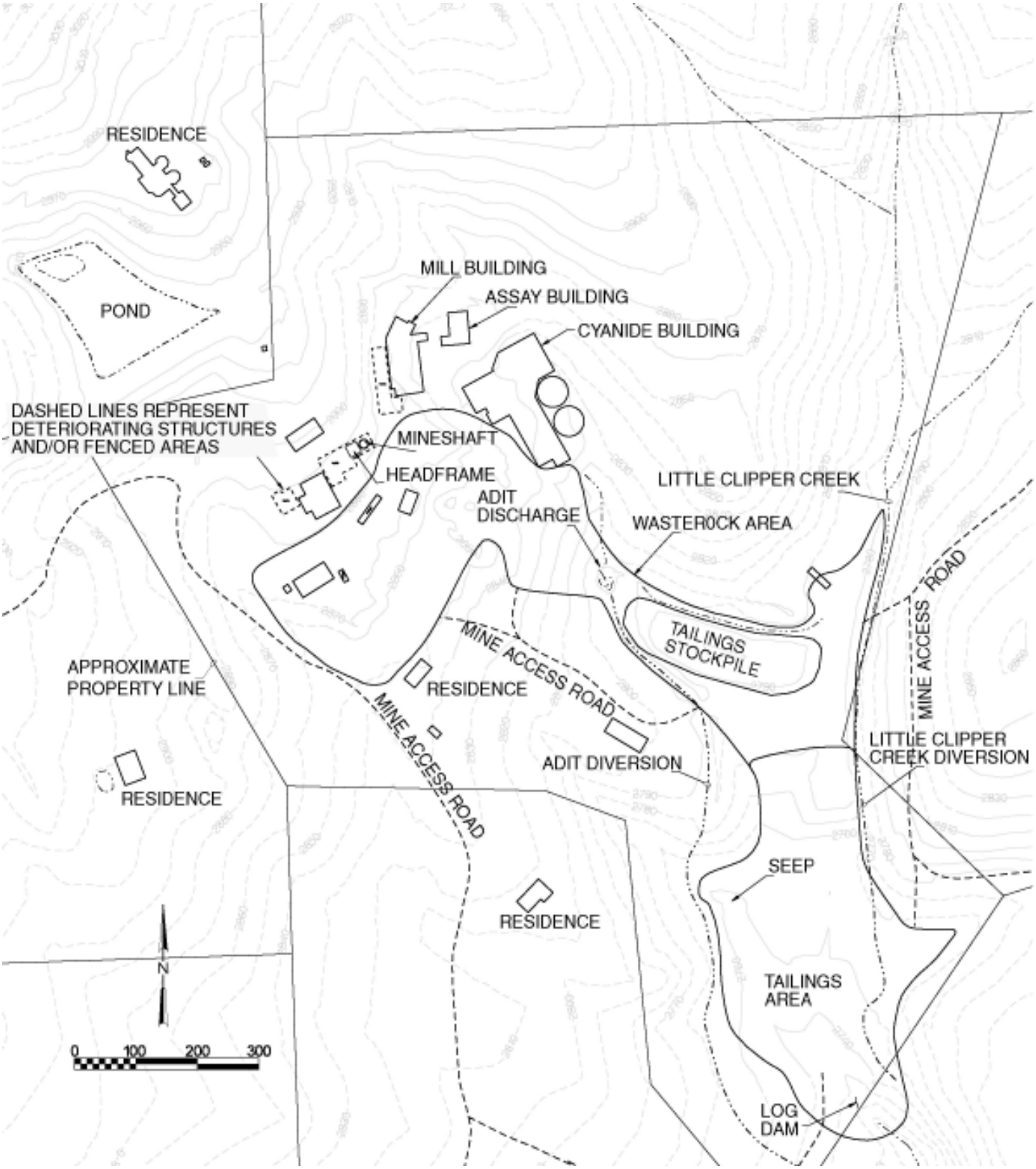


Figure 3: *Lava Cap Mine Site Features*

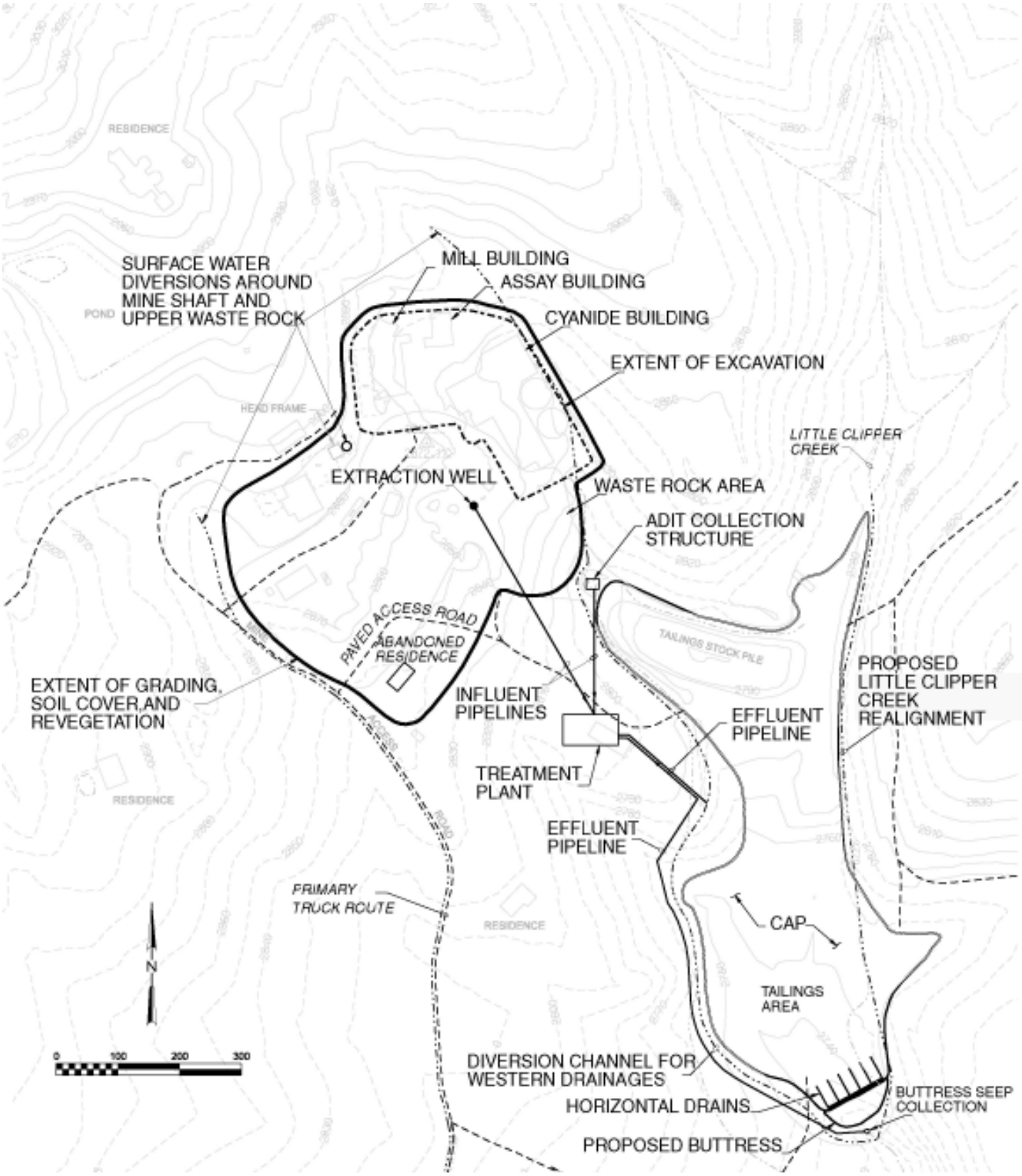
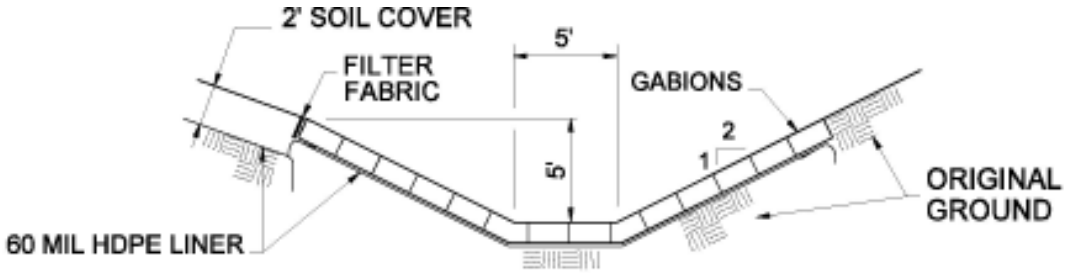
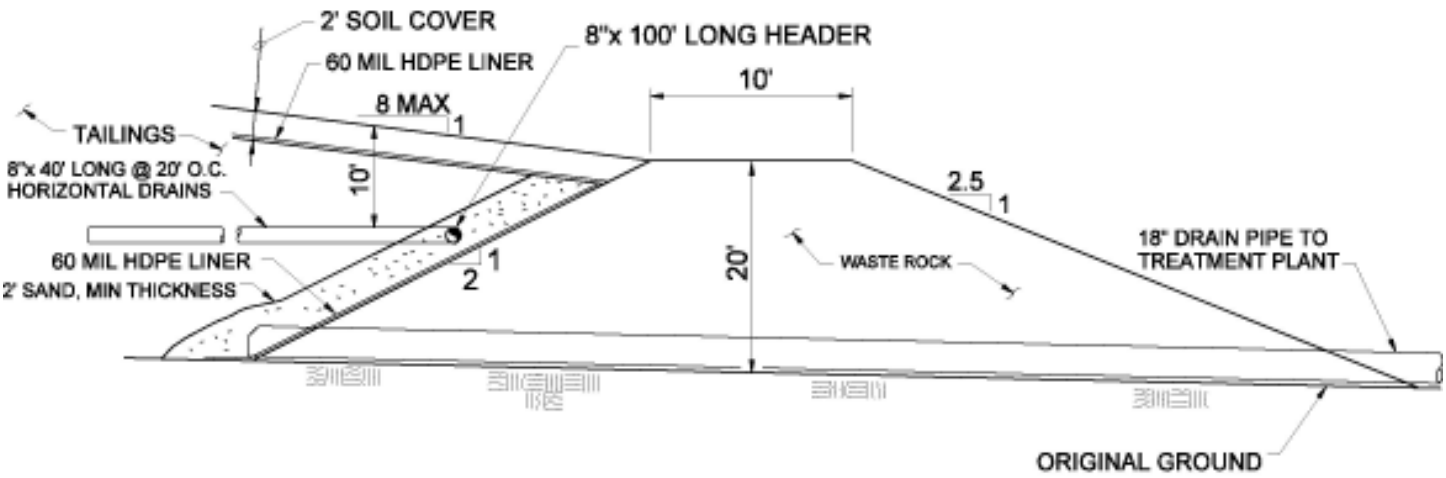


Figure 4: *Lava Cap Mine Site, showing proposed Alternative 2-3 Construction*



LITTLE CLIPPER CREEK
TYPICAL CROSS SECTION



TYPICAL BUTTRESS CROSS SECTION

Figure 5: *Diagram of Capping and Buttress Technology, U.S. EPA's Preferred Alternative 2-3*